Effects of Practice Variability on Motor Learning of the Relaxed Phonation Task

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Introduction

- Hyperfunctional voice disorder
  - the use of excessive laryngeal muscle tension during phonation (Freeman & Fawcus, 2001).
  - Commonly treated with relaxation exercises.
Motor Learning

- Definition
  - “A set of processes associated with practice or experience leading to relatively permanent changes in the capability for movement” (Schmidt & Lee, 1999, pp. 264).

- Evaluated by long-term follow-up tests:
  - Retention test
  - Generalization transfer test
Motor Learning

- Variables that affect motor learning:
  - Frequency of feedback
  - Timing of feedback
  - Practice variability
Practice Variability

Definition

- Movement variety and context characteristics a learner experiences when practising a motor skill (Magill, 1998)

Three types of practice conditions

- Constant practice
- Blocked practice
- Random practice
Contextual Interference

Disruption effects on performance and learning brought by the context of the task (Schmidt & Wrisberg, 2000)

<table>
<thead>
<tr>
<th>Contextual interference (CI)</th>
<th>Performance: acquisition</th>
<th>Performance: retention &amp; transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>High CI (e.g. random practice)</td>
<td>Poor 😞</td>
<td>Good 😊</td>
</tr>
<tr>
<td>Low CI (e.g. constant practice)</td>
<td>Good 😊</td>
<td>Poor 😞</td>
</tr>
</tbody>
</table>
Previous Motor Learning Studies

- Effects of practice variability on motor learning in sports sciences and communication disorders (Shea & Morgan, 1979; Knock, et. al., 2000)

  - Participants in the random practice group demonstrated more motor learning than that in the blocked practice group
Yu (2005) examined the effects of practice variability of learning relaxed phonation on 20 vocally healthy individuals.

- No significant difference on group effect was found between random practice group and blocked practice group.
Objective

To investigate the effects of practice variability on the learning of relaxed phonation in dysphonic individuals

Hypothesis: Participants from the random practice group would demonstrate the best motor learning on relaxed phonation than the other two groups
Methods

- 21 participants (18 females and 3 males)
  - Aged between 20 to 50 years old
  - Dysphonic
  - Could speak and read Cantonese fluently
  - Have not received voice therapy
  - Have not had any experience in using surface electromyography
  - Passed a hearing screening between 2kHz to 8kHz at 30dB HL
Methods

- Experimental set-up
  - sEMG system
  - Labview program
  - Two pairs of electrodes

Figure 1. Electrodes for the sEMG

Figure 2. Two sites of surface electrode placement in this study
Methods

3 lists of training stimuli

- Four blocks in each training list and 24 target characters in each block

<table>
<thead>
<tr>
<th>Constant</th>
<th>Blocked</th>
<th>Random</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four characters</td>
<td>Increasing lengths of sentence stimuli across four blocks</td>
<td>Variations of different lengths of sentence stimuli (2 to 5 characters) in random order</td>
</tr>
<tr>
<td>Block 1: 依個係的</td>
<td>Block 1: 係的</td>
<td></td>
</tr>
<tr>
<td>Block 2: 依個係的</td>
<td>Block 2: 請講的</td>
<td></td>
</tr>
<tr>
<td>Block 3: 依個係的</td>
<td>Block 3: 依個係的</td>
<td></td>
</tr>
<tr>
<td>Block 4: 依個係的</td>
<td>Block 4: 依個字係的</td>
<td></td>
</tr>
</tbody>
</table>
**Experimental Design**

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Pre-training baseline (session 1)</th>
<th>Training sessions (session 2 – 9)</th>
<th>Post-training measurement (session 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentence stimuli</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes (Retention test)</td>
</tr>
<tr>
<td>Paragraph (North Wind and the Sun)</td>
<td>Yes</td>
<td>No</td>
<td>Yes (Transfer test)</td>
</tr>
<tr>
<td>VAPP</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Note: ‘Yes’ denotes the presence of tasks while ‘No’ denotes the absence of tasks
Labview Interface (Ma, Wong & Tse, 2008)

① Sentence stimuli presented with prompts for participants to read aloud

② Root-mean-square values of the sEMG signals recorded at the thyrohyoid muscle site
Effects of Learning

Results:

✓ Time effect (\(p = 0.05\))
✓ Site effect (\(p = 0.001\))
✗ Group effect
✗ Interaction effects

Key:
- Constant Group
- Blocked Group
- Random Group

Key: B – Pretreatment baseline  T – Training  R – Retention

Figure 4. Changes of muscle tension of all participants across 10 measurements
Effects of Generalization

Results:

✓ Time effect
✗ Group effect

Figure 5. Changes of muscle tension of all participants across two measurements (pre-treatment baselines and transfer test)
VAPP as Outcome Measures

- Significant main time effect was observed in Total VAPP scores ($p = 0.002$)

<table>
<thead>
<tr>
<th>Total VAPP scores</th>
<th>Constant</th>
<th>Blocked</th>
<th>Random</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-VAPP</td>
<td>135.9</td>
<td>147.9</td>
<td>138.3</td>
</tr>
<tr>
<td>Post-VAPP</td>
<td>76.0</td>
<td>111.7</td>
<td>137.9</td>
</tr>
</tbody>
</table>

Note: The possible maximum score will be 280
Discussion

- Significant main time effect on motor learning and motor generalization
  - EMG voltages dropped significantly across time at both muscle sites

Clinical implication: relaxation exercise was effective
Discussion

- Significant main time effect on Total VAPP scores

Suggests the effectiveness of relaxed phonation therapy
Future Studies

Future studies are currently conducted

- To include more participants in each practice condition (N >7) to demonstrate group effect

- To include perceptual rating and instrumental voice analysis (e.g. aerodynamic measurements) as outcome measures